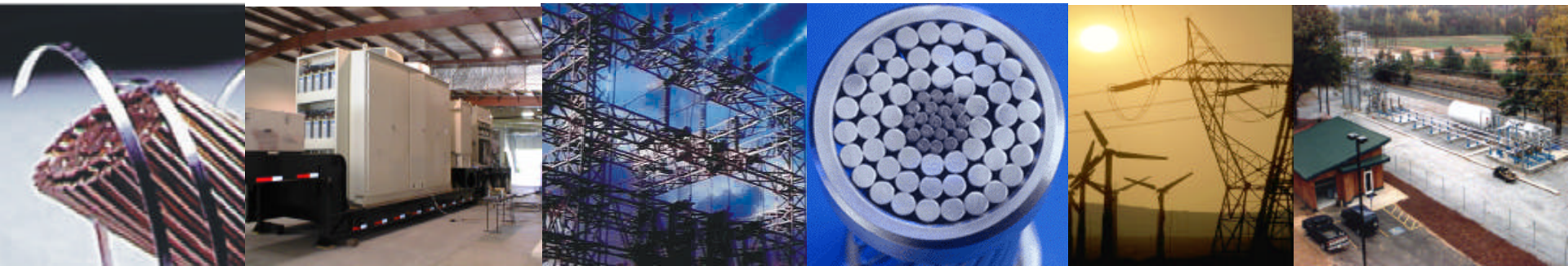
Transforming the Grid to Revolutionize Electric Power in North America

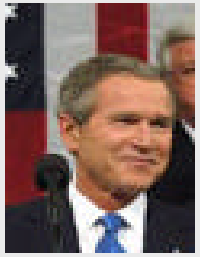
January 27, 2004

Jimmy Glotfelty
Office of Electric Transmission and Distribution
U.S. Department of Energy



Electricity Modernization

"...it's clear that the power grid needs an overhaul. It needs to be modernized. As we go into an exciting new period of American history, we want the most modern electricity grid for our people... we need more investment; we need research and development..."

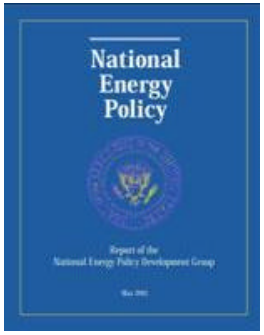


George W. Bush
September 15, 2003

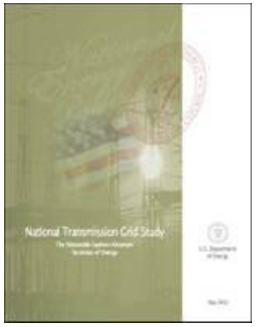
Leadership from all Levels

"…It is a plan to modernize our electricity delivery system. It is a plan which is needed now. It is needed for economic security. It is needed for national security…"

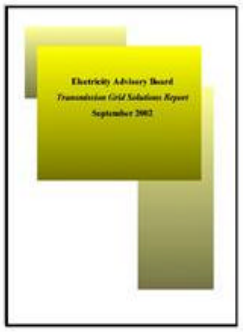
George W. Bush February 6, 2003



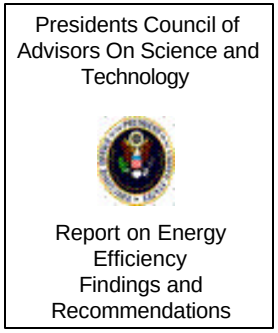
May 2001



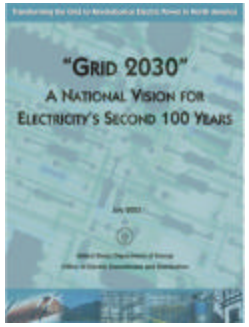
May 2002



Sept 2002



April 2003



July 2003

Draft Sept2003

"When the lights go out, modern life as we know it grinds to a sudden halt. Transportation is interrupted, communications fail, water systems shut down, factory work is disrupted, food spoils, businesses lose money, and people are inconvenienced and even endangered. "

Spencer Abraham, September 3, 2003

Electricity and Economic Growth

"If the energy structure of this country is inadequate or in some way excessively costly, it will undermine economic growth, and is therefore a major issue that must be addressed."

Alan Greenspan
Chairman, Federal Reserve Board
January 25, 2001

August 14th Blackout

By-The-Numbers

- 2 Canadian Provinces
- 3 deaths
- 8 U.S. states
- 12 airports closed
- 23 cases of looting in Ottawa
- 250+ power plants
- 9,266 square miles
- 61,800 MW of power lost
- 1.5 million Cleveland residents without water
- 50 million people
- $6,012 billion in economic activity lost

National Reliability Challenges

- ***Prevention*** **– keep problems from occurring**
- ***Detection*** **– ready for immediate action**
- ***Response*** **– proper ”tool kits” for any contingency**
- ***Modernization*** **– “next generation” of grid technologies**

Prevention

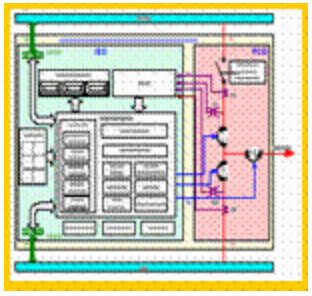
Stop reliability problems from occurring in the first place

Technologies for Today

- Advanced conductors and tower designs
- Modeling and system planning tools
- Communications
- Training

Composite Core Conductors

Communications Systems



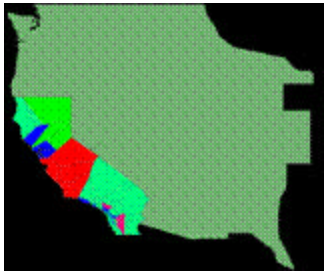
Modeling and Simulation Packages

Training Seminars

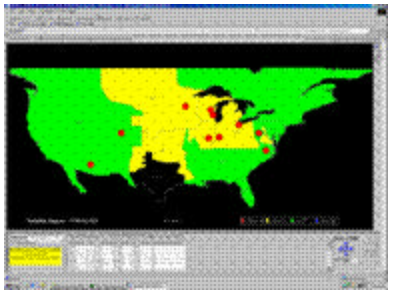
Detection

Improve grid operator readiness for taking action immediately

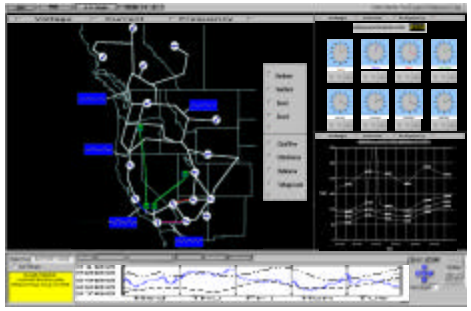
- **Monitoring Systems**
  - **Frequencies**
  - **Voltages**
  - **VARs**
  - **Phasors**
  - **Line Sag**
- **Data Acquisition**
- **Visualization Tools**
- **Communications**
- **Training**



Voltage and VAR Monitoring



ACE Frequency Monitoring



Synchronized Phasor Applications

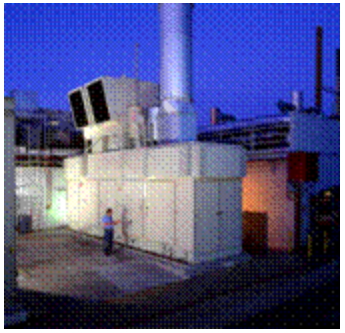
Distributed Sensing and Controls Systems

Response

Equip operators with a portfolio of resources comprising the best available tools and techniques

Technologies for Today

- **Distributed Generation**
- **Energy Storage Systems**
- **Demand Response**
- **Communications**



Industrial Gas Turbines

Aggregated Water Pumping Loads

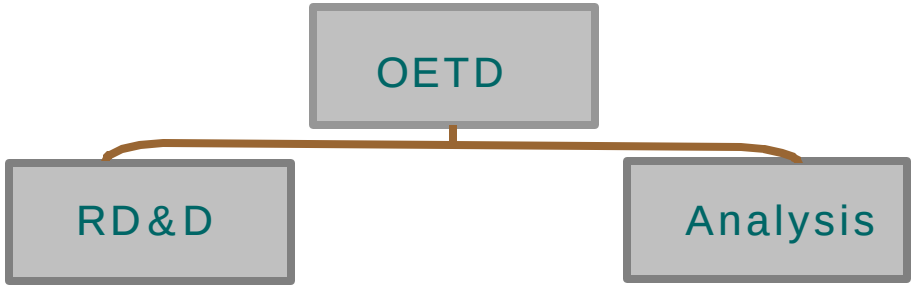
Zinc-Bromine Battery System

Smart Thermostat

Reciprocating Engine Gen Sets

Microturbines

Office of Electric T&D



Electric Systems RD&D

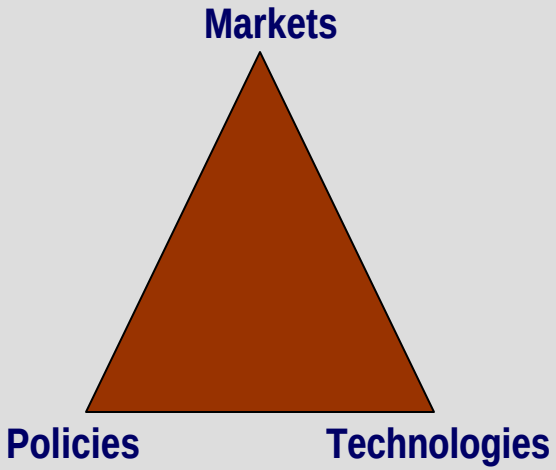
- Transmission Systems
  - Including high capacity conductors
- Distribution and Integration
  - Including interconnection of distributed energy
- Electricity Storage
- Superconductivity

Electric Power Systems Operations and Analysis

- Electricity Policy Modeling and Analysis
  - Provide Check/Balance to the FERC
- Electricity Restructuring
- Electricity Exports
  - Including Presidential Permits
- Power Marketing Administration Liaison

U.S. DOE's Strategic Response

An Integrated Approach



Electricity RD&D

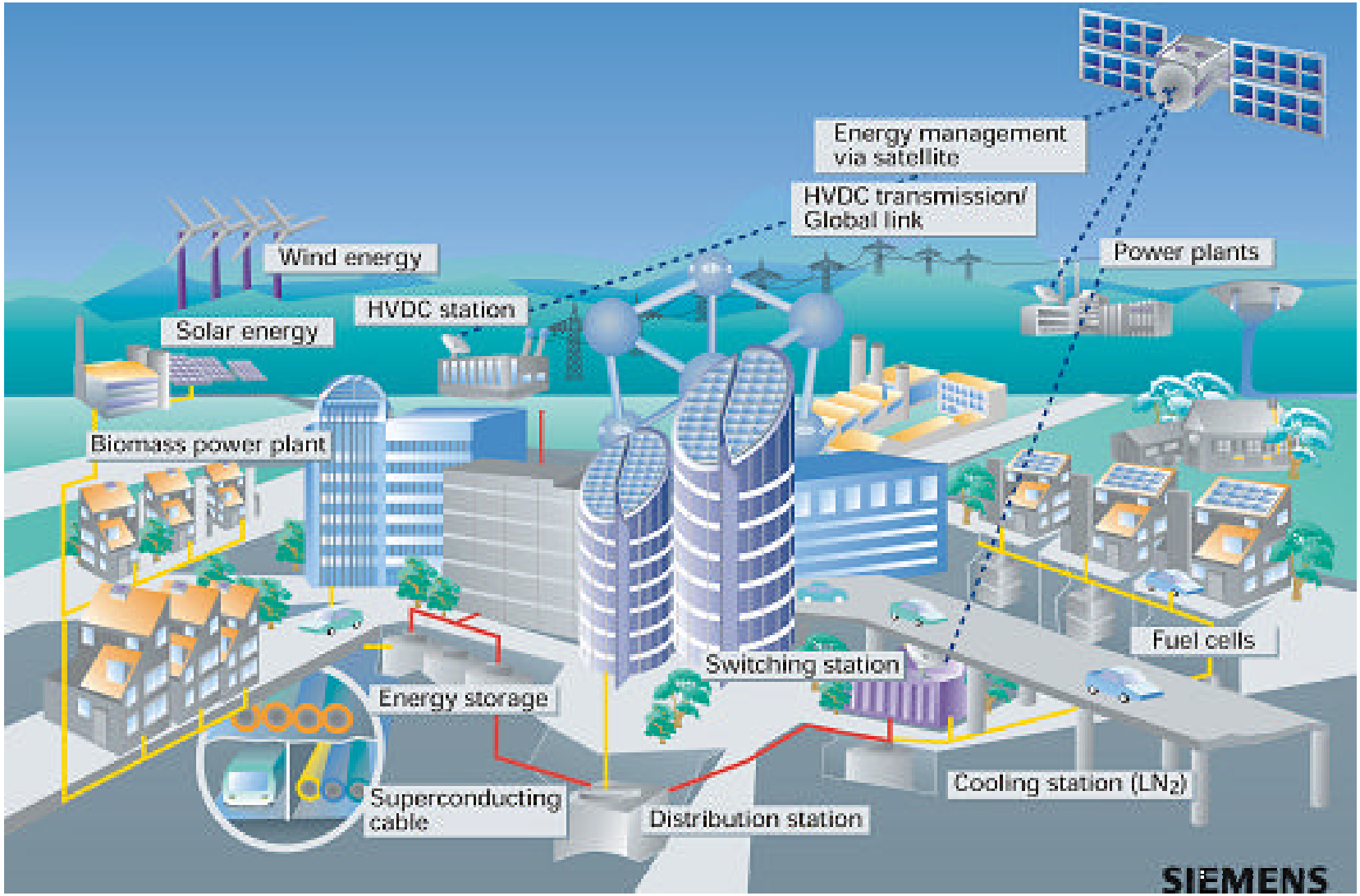
Analysis, modeling, and data

Federal, Regional, and State Coordination

OETD Mission

To lead a national effort to modernize and expand America's electric delivery system to ensure a more reliable and robust electricity supply, as well as economic and national security.

The Vision ... “Grid 2030”



Electric Delivery Technologies Roadmap

An *Action Agenda* for Turning the Vision into Reality

Design "Grid 2030" Architecture

Conceptual framework that guides development of the electric system from transmission to end-use

Develop Critical Technologies

Advanced conductors, electric storage, high-temperature superconductors, distributed intelligence/smart controls, and power electronics that become building blocks for "Grid 2030"

Accelerate Technology Acceptance

Field testing and demonstrations that move the advanced technologies from the laboratory and into the "tool kit" of transmission and distribution system planners and operators

Strengthen Market Operations

Assessing markets, planning, and operations; improving siting and permitting; and addressing regulatory barriers bring greater certainty and lower financial risks to electric transactions and investment

Build Partnerships

Leveraging stakeholder involvement through multi-year, public-private partnerships; working with States to address shared concerns

Public-Private Partnerships

- Electricity Consumers
- Electric and Gas Utilities
- Independent System Operators
- Independent Power Producers
- Equipment Manufacturers
- IT Companies
- State Agencies
- Other Federal Agencies
- Canada, Mexico, and other countries
- Trade Associations
- Environmental and Labor Groups
- Universities
- National Laboratories

Energy Legislation

- **Mandatory Reliability**
- **RTO's**
- **Incentive Rates**
- **Standard Market Design**
- **Transmission Siting**
- **Transmission Tax Incentives**

Conclusion

"We will work to unleash innovation and strengthen our markets to allow entrepreneurs to develop a more advanced and robust transmission system that meets growing energy demand in the years ahead."

Secretary of Energy
Spencer Abraham